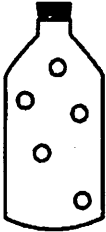
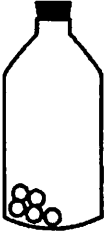
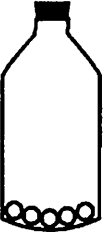

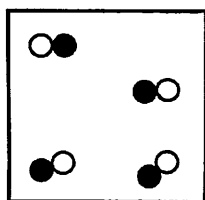


1. Which phase change results in the release of energy?
- 1) $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(l)$ 3) $\text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{O}(g)$
 2) $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(g)$ 4) $\text{H}_2\text{O}(g) \rightarrow \text{H}_2\text{O}(l)$
2. As ice melts at standard pressure, its temperature remains at 0°C until it has completely melted. Its potential energy
- 1) decreases 3) remains the same
 2) increases
3. At which Celsius temperature does lead change from a solid to a liquid?
- 1) 874°C 3) 328°C
 2) 601°C 4) 0°C
4. Which substance has vibrating particles in regular, fixed positions?
- 1) $\text{Ca}(s)$ 3) $\text{Cl}_2(g)$
 2) $\text{Hg}(l)$ 4) $\text{CaCl}_2(aq)$
5. As ice at 0°C changes to water at 0°C , the average kinetic energy of the ice molecules
- 1) decreases 3) remains the same
 2) increases
6. At a pressure of 1 atmosphere, what is the temperature of a mixture of steam and water at equilibrium?
- 1) 100°C 3) 273°C
 2) 212°C 4) 373°C
7. A sample of a gas is contained in a closed rigid cylinder. According to kinetic molecular theory, what occurs when the gas inside the cylinder is heated?
- 1) The number of gas molecules increases.
 2) The number of collisions between gas molecules per unit time decreases.
 3) The average velocity of the gas molecules increases.
 4) The volume of the gas decreases.
8. Which substance will readily sublime at STP?
- 1) $\text{Fe}(s)$ 3) $\text{NaCl}(s)$
 2) $\text{C}_6\text{H}_{12}\text{O}_6(s)$ 4) $\text{CO}_2(s)$
9. Which diagram best represents a gas in a closed container?
- 1)  3) 
- 2)  4) 
10. Which statement describes a chemical property of the element magnesium?
- 1) Magnesium is malleable.
 2) Magnesium conducts electricity.
 3) Magnesium reacts with an acid.
 4) Magnesium has a high boiling point.
11. Which process is a chemical change?
- 1) melting of ice
 2) boiling of water
 3) subliming of ice
 4) decomposing of water
12. Which physical changes are endothermic?
- 1) melting and freezing
 2) melting and evaporating
 3) condensation and sublimation
 4) condensation and deposition
13. An 80.0-gram sample of water at 10.0°C absorbs 1680 Joules of heat energy. What is the final temperature of the water?
- 1) 50.0°C 3) 5.00°C
 2) 15.0°C 4) 4.00°C
14. What amount of heat is required to completely melt a 29.95-gram sample of $\text{H}_2\text{O}(s)$ at 0°C ?
- 1) 334 J 3) $1.00 \times 10^3 \text{ J}$
 2) 2260 J 4) $1.00 \times 10^4 \text{ J}$

15. Given the particle diagram representing four molecules of a substance:



Which particle diagram best represents this same substance after a physical change has taken place?

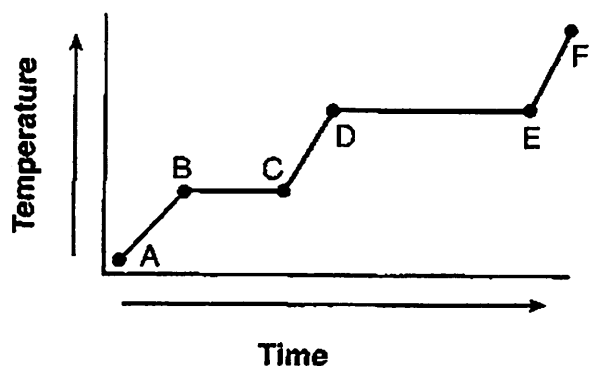
1)

2)

3)

4)

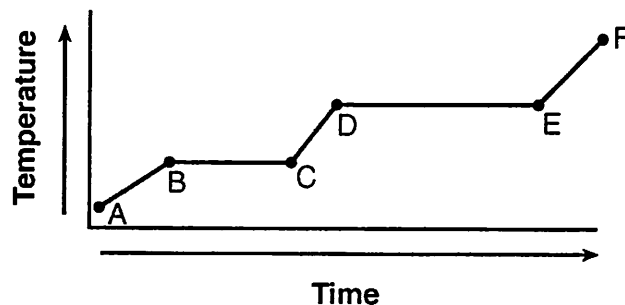
16. The graph below represents the uniform heating of a substance, starting below its melting point, when the substance is solid.



Which line segments represent an increase in average kinetic energy?

- 1) \overline{AB} and \overline{BC} 3) \overline{BC} and \overline{DE}
 2) \overline{AB} and \overline{CD} 4) \overline{DE} and \overline{EF}

17. The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.

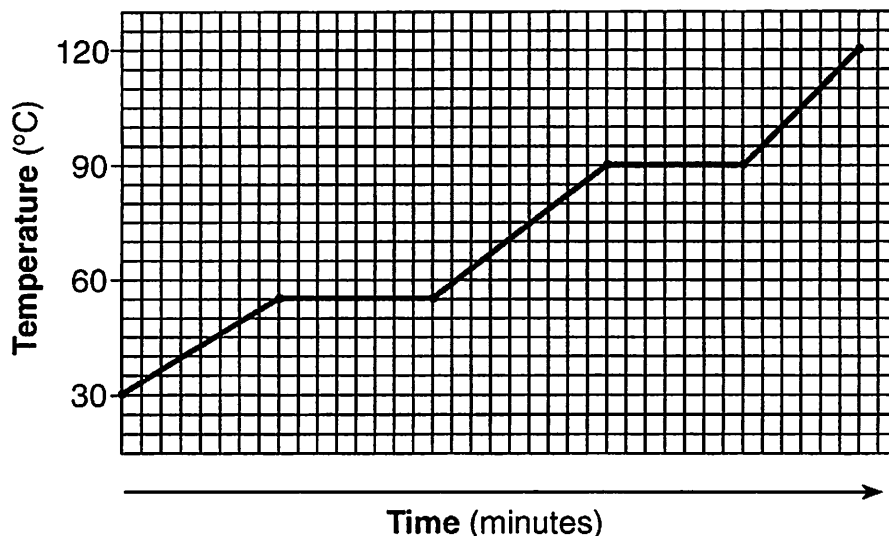


Which line segment represents an increase in potential energy and no change in average kinetic energy?

- 1) \overline{AB} 3) \overline{CD}
 2) \overline{BC} 4) \overline{EF}

18. When 200 grams of water cools from $50.^{\circ}\text{C}$ to $25.^{\circ}\text{C}$, the total amount of heat energy released by the water is
- 1) 42 kJ 3) 34 J
 2) 21 kJ 4) 17 J
19. How much heat energy must be absorbed to completely melt 35.0 grams of $\text{H}_2\text{O}(\text{s})$ at $0.^{\circ}\text{C}$?
- 1) 9.54 J 3) 11 700 J
 2) 146 J 4) 79 100 J
20. How much energy is required to vaporize 10.00 grams of water at its boiling point?
- 1) 2.26 kJ 3) 4.2 kJ
 2) 3.34 kJ 4) 22.6 kJ
21. Which will sublime when heated?
- 1) $\text{SO}_2(\text{aq})$ 3) $\text{N}_2(\text{g})$
 2) $\text{H}_2\text{O}(\ell)$ 4) $\text{I}_2(\text{s})$
22. A dilute, aqueous potassium nitrate solution is best classified as a
- 1) homogeneous compound
 2) homogeneous mixture
 3) heterogeneous compound
 4) heterogeneous mixture
23. Which must be a mixture of substances?
- 1) solid 3) gas
 2) liquid 4) solution

24. The graph below represents the heating curve of a substance that starts as a solid below its freezing point.



What is the melting point of this substance?

- 1) 30°C 2) 55°C 3) 90°C 4) 120°C

25. Bronze contains 90 to 95 percent copper and 5 to 10 percent tin. Because these percentages can vary, bronze is classified as

- 1) a compound 3) a mixture
2) an element 4) a substance

26. A mixture of crystals of salt and sugar is added to water and stirred until all solids have dissolved. Which statement best describes the resulting mixture?

- 1) The mixture is homogeneous and can be separated by filtration.
2) The mixture is homogeneous and cannot be separated by filtration.
3) The mixture is heterogeneous and can be separated by filtration.
4) The mixture is heterogeneous and cannot be separated by filtration.

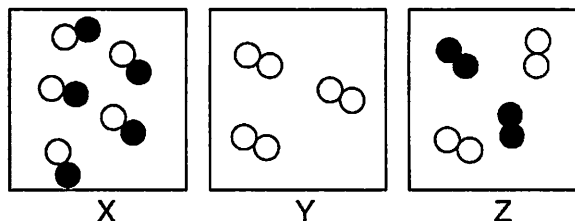
27. When a mixture of water, sand, and salt is filtered, what passes through the filter paper?

- 1) water, only 3) water and salt, only
2) water and sand, only 4) water, sand, and salt

28. Which process would most effectively separate two liquids with different molecular polarities?

- 1) filtration 3) distillation
2) fermentation 4) conductivity

29. Given the diagrams X, Y, and Z below:



Key	
Atom of element A =	○
Atom of element B =	●

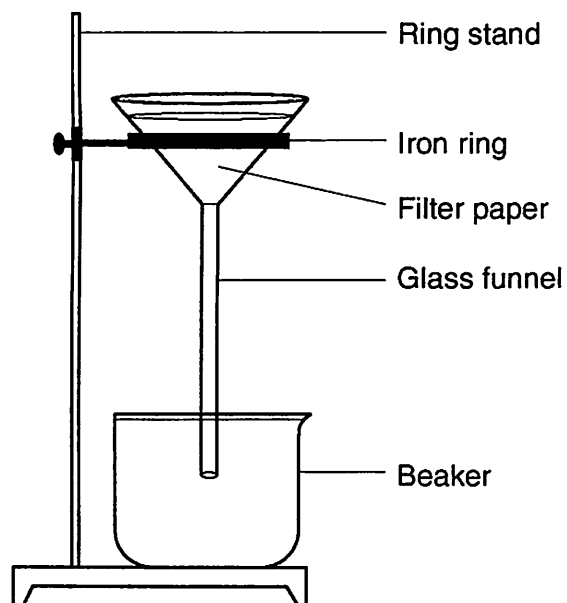
Which diagram or diagrams represent a mixture of elements A and B?

- 1) X, only 3) X and Y
2) Z, only 4) X and Z

30. Which property makes it possible to separate the oxygen and the nitrogen from a sample of liquefied air?

- 1) boiling point 3) hardness
2) conductivity 4) electronegativity

31. Which mixture can be separated by using the equipment shown below?



- 1) NaCl(aq) and $\text{SiO}_2(\text{s})$
 - 2) NaCl(aq) and $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$
 - 3) $\text{CO}_2(\text{aq})$ and NaCl(aq)
 - 4) $\text{CO}_2(\text{aq})$ and $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$
32. The temperature of a sample of water changes from $10.^\circ\text{C}$ to $20.^\circ\text{C}$ when the water absorbs 420 Joules of heat. What is the mass of the sample?
- 1) 1.0 g
 - 2) 10. g
 - 3) 100 g
 - 4) 1000 g
33. What is the total amount of heat energy, in joules, absorbed by 25.0 grams of water when the temperature of the water increases from 24.0°C to 36.0°C ?

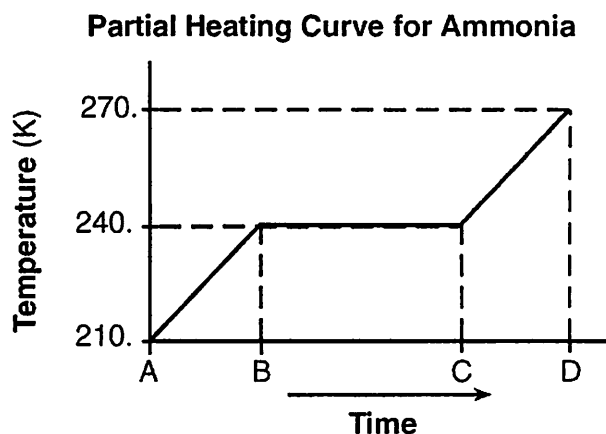
34. Base your answer to the following question on the information below.

A battery-operated smoke detector produces an alarming sound when its electrical sensor detects smoke particles. Some ionizing smoke detectors contain the radioisotope americium-241, which undergoes alpha decay and has a half-life of 433 years. The emitted alpha particles ionize gas molecules in the air. As a result, an electric current flows through the detector. When smoke particles enter the detector, the flow of ions is interrupted, causing the alarm to sound.

Write the nuclear equation below for the decay of Am-241. Your response must include the symbol, mass number, and atomic number for each product.

Base your answers to questions 35 through 37 on the information below

A 5.00-gram sample of liquid ammonia is originally at 210. K. The diagram of the partial heating curve below represents the vaporization of the sample of ammonia at standard pressure due to the addition of heat. The heat is *not* added at a constant rate.



Some physical constants for ammonia are shown in the data table below.

Some Physical Constants for Ammonia

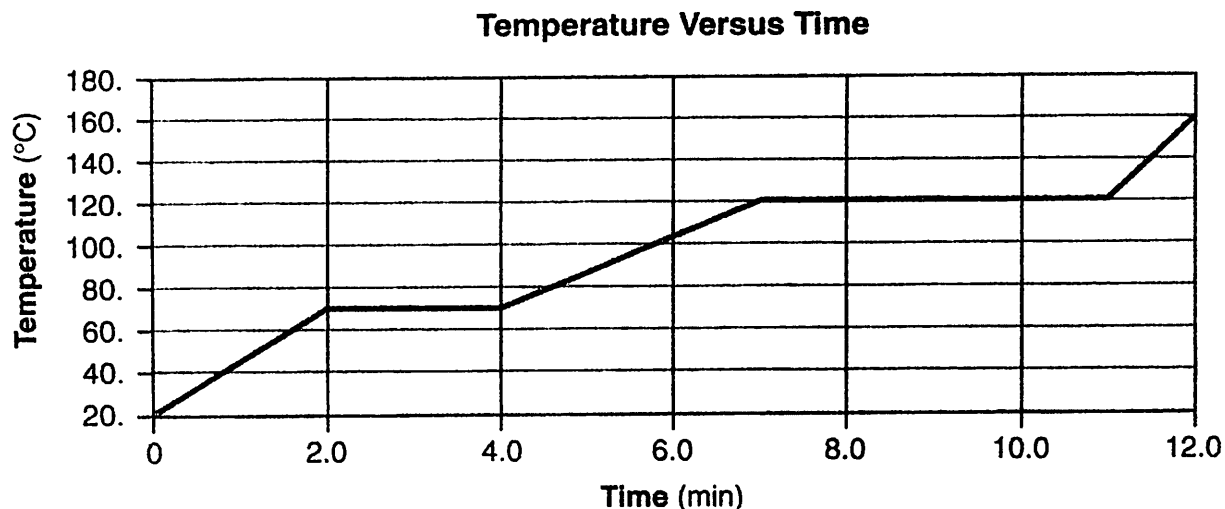
specific heat capacity of $\text{NH}_3(\ell)$	4.71 J/g \cdot K
heat of fusion	332 J/g
heat of vaporization	1370 J/g

35. Calculate the total heat absorbed by the 5.00-gram sample of ammonia during time interval AB. Your response must include *both* a correct numerical setup and the calculated result.
36. Describe what is happening to *both* the potential energy and the average kinetic energy of the molecules in the ammonia sample during time interval BC. Your response must include *both* potential energy and average kinetic energy.

37. Determine the total amount of heat required to vaporize this 5.00-gram sample of ammonia at its boiling point.

Base your answers to questions 38 through 41 on the information below.

The temperature of a sample of a substance is increased from 20.°C to 160.°C as the sample absorbs heat at a constant rate of 15 kilojoules per minute at standard pressure. The graph below represents the relationship between temperature and time as the sample is heated.

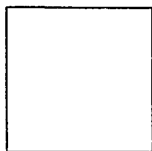


38. What is the total time this sample is in the liquid phase, only?

39. What is the boiling point of this sample?

40. Use the key below to draw at least nine particles in the box, showing the correct particle arrangement of this sample during the first minute of heating.

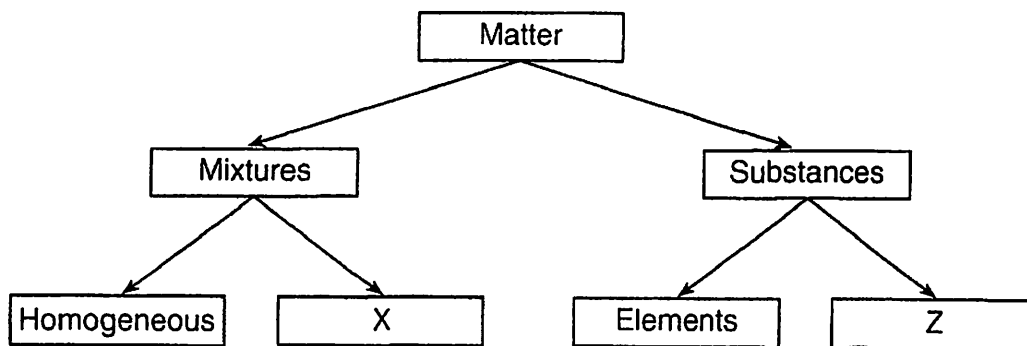
Key
○ = particle of the substance



41. Determine the total amount of heat required to completely melt this sample at its melting point.

Base your answers to questions 42 through 45 on the diagram below concerning the classification of matter.

Classification of Matter



42. Given a mixture of sand and water, state *one* process that can be used to separate water from the sand.
43. What type of mixture is represented by *X*?
44. What type of substance is represented by *Z*?
45. Explain, in terms of particle arrangement, why NaCl(aq) is a homogeneous mixture.